EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	88	((substrate or wafer or workpiece) and (treating or treatment or treated) and (high adj density adj plasma) and oxide and silicon).clm.	US-PGPUB; USPAT	OR	ON	2006/05/26 13:43
L2	48	((substrate or wafer or workpiece) and (treating or treatment or treated) and (high adj density adj plasma) and oxide and silicon and temperature).clm.	US-PGPUB; USPAT	OR	ON	2006/05/26 13:50
L3	45	2 and @ad<"20040315"	US-PGPUB; USPAT	OR	ON	2006/05/26 13:50
L4	2535	438/788,798,787,792,778.ccls. and @ad<"20040315"	US-PGPUB; USPAT	OR	ON	2006/05/26 13:50
L5	353	4 and (substrate or wafer or workpiece) and (high adj density adj plasma) and oxide and silicon and temperature	US-PGPUB; USPAT	OR	ON	2006/05/26 13:51
L6	345	5 not 3	US-PGPUB; USPAT	OR	ON	2006/05/26 13:51

US-PAT-NO: 6887767

DOCUMENT-IDENTIFIER: US 6887767 B2

TITLE: Method for manufacturing semiconductor device

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Claims Text - CLTX (1):

1. A method for manufacturing a semiconductor device, the method comprising: forming a buffer film on a semiconductor **substrate**; forming a mask having a trench formation pattern on the buffer film; forming an element partitioning trench corresponding to the trench formation pattern with the mask; and oxidizing a surface of the element partitioning trench to form an oxidized film on the surface, wherein the distance between a top edge of the element partitioning trench and an end of the buffer film is less than or equal to one half of a thickness of the oxidized film along a plane parallel to the semiconductor **substrate**.

Claims Text - CLTX (4):

4. A method for manufacturing a semiconductor device, the method comprising: forming a buffer film on a semiconductor **substrate**; forming a mask having a trench formation pattern on the buffer film; forming an element partitioning trench corresponding to the trench formation pattern with the mask; and oxidizing a surface of the element partitioning trench to form an oxidized film on the surface of the element partitioning trench, wherein prior to said oxidizing, the buffer film is removed from a top edge of the element partitioning trench by a distance represented by the expression:

Claims Text - CLTX (7):

7. A method for manufacturing a semiconductor device, the method comprising: forming an element partitioning trench on a semiconductor **substrate** with a mask; filling the element partitioning trench with an insulative material; heat **treating,** after said filling operation, the insulative material to increase etching resistance of the insulative material; removing the mask after said heat **treating** operation; and forming a drive element on the semiconductor **substrate**.

Claims Text - CLTX (9):

9. The method according to claim 7, wherein said heat **treating** includes

increasing the density of the insulative material.

Claims Text - CLTX (10):
10. An improvement of a method for manufacturing a semiconductor device, wherein the method includes forming an clement partitioning trench on a semiconductor **substrate,** filling the element partitioning trench with an insulative material, forming a drive element on the semiconductor device, and performing etching with hydrofluoric acid between said forming an element partitioning trench and said forming a drive element, the improvement comprising: heat **treating** the insulative material to decrease the rate for etching the insulative material with the hydrofluoric acid by exposing the insulative material in the trench to a first atmosphere at a first elevated **temperature** for a first predetermined period; and thereafter exposing the insulative material in the trench to a second atmosphere at a second elevated **temperature** for a second predetermined period, wherein the second elevated **temperature** is higher than the first elevated **temperature**.

Claims Text - CLTX (11):
11. The method according to claim 10, wherein said heat **treating** includes heat **treating at a temperature** of 1,000.degree. C. or greater.

Claims Text - CLTX (12):
12. The method according to claim 11, wherein the first elevated **temperature is at a temperature** less than 1,000.degree. C. and the second elevated **temperature is at a temperature** of 1,000.degree. C. or greater.

Claims Text - CLTX (13):
13. A method for manufacturing a semiconductor device comprising: forming an element partitioning trench on a semiconductor **substrate**; filling an insulative material in the element partitioning trench; and heat **treating** the insulative material in a plurality of steps to reduce stress that is produced by volume change of the insulative material, wherein one step includes exposing the insulative material to a first atmosphere at a first **temperature** for a first predetermined period, and another step includes exposing the insulative material in a second atmosphere at a second **temperature** for a second predetermined period, the second **temperature** being higher than the first **temperature**.

Claims Text - CLTX (14):
14. The method according to claim 13, wherein the first **temperature** is less than 1,000.degree. C., and the second **temperature** is 1,000.degree. C. or greater.

Claims Text - CLTX (15):
15. The method according to claim 13, wherein the insulative material is a **silicon oxide** film, and said exposing the insulative material at a second **temperature** is performed in an atmosphere including oxygen and inert gas.

Claims Text - CLTX (16):
16. A method for manufacturing a semiconductor device comprising: forming an element partitioning trench on a semiconductor **substrate**; filling an insulative material in the element partitioning trench; heat **treating** the insulative material in a plurality of steps, wherein one step includes exposing the insulative material to a first atmosphere at a first **temperature** for a predetermined period, and another step includes exposing the insulative material in a second atmosphere at a second **temperature** for a second predetermined period, the second **temperature** being higher than the first **temperature**; and flattening an upper surface of the insulative material.

Claims Text - CLTX (17):
17. The method according to claim 16, wherein the insulative material is a **high density plasma silicon oxide** film, and said heat **treating** includes maintaining the insulative material at the first **temperature** under an atmosphere that does not include oxygen, and then maintaining the insulative material at the second **temperature** under an atmosphere that includes oxygen gas.

Claims Text - CLTX (18):
18. The method according to claim 17, wherein the first **temperature** is less than 1,000.degree. C., and the second **temperature** is 1,000.degree. C. or greater.

Claims Text - CLTX (19):
19. A method for manufacturing a semiconductor device comprising: forming a buffer film on a semiconductor **substrate**; forming a mask having a trench formation pattern on the buffer film; forming an element partitioning trench corresponding to the trench formation pattern with the mask; acid-washing a surface of the element partitioning trench, wherein said acid-washing removes part of the buffer film that is adjacent to the element partitioning trench, the buffer film being inwardly removed by a predetermined distance from a top edge of the element partitioning trench; and oxidizing the surface of the element partitioning trench to form an oxidized film on the surface, wherein a condition of said acid-washing and a condition of said oxidizing are determined so that the predetermined distance is less than or equal to one half of a

thickness of the oxidized film that is measured along a surface parallel to the semiconductor **substrate**.

Claims Text - CLTX (20):
20. A method for manufacturing a semiconductor device, the method compromising: forming a buffer film on a semiconductor **substrate**; forming a mask having a trench formation pattern on the buffer film; forming an element partitioning trench corresponding to the trench formation pattern with the mask; and oxidizing a surface of the element partitioning trench to form an oxidized film on the surface, wherein prior to said oxidizing, an end of the buffer film is removed from a top edge of the element partitioning trench by an adjusted distance that is less than or equal to one half of a thickness of the oxidized film along a plane parallel to the semiconductor **substrate**.

Claims Text - CLTX (21):
21. The method according to claim 10, wherein said heat **treating** includes gradually elevating the **temperature** from the first **temperature** to the second **temperature**.

Claims Text - CLTX (23):
23. The method according to claim 21, wherein the insulative material is exposed at a **temperature** that is higher than the first **temperature** for a period that is longer than the predetermined period.

Claims Text - CLTX (26):
26. The method according to claim 13, wherein said heat **treating** includes gradually elevating the **temperature** from the first **temperature** to the second **temperature**.

Claims Text - CLTX (28):
28. The method according to claim 26, wherein the insulative material is exposed at a **temperature** that is higher than the first **temperature** for a period that is longer than the first predetermined period.

Claims Text - CLTX (31):
31. The method according to claim 16, wherein said heat **treating** includes gradually elevating the **temperature** from the first **temperature** to the second **temperature**.

Claims Text - CLTX (33):
33. The method according to claim 31, wherein the insulative material is exposed at a **temperature** that is higher than the first **temperature** for a period

that is longer than the first predetermined period.

Claims Paragraph Equation - CLEQ (1):

0.ltoreq.x.ltoreq.(d/2 sin .theta.) where x represents the removed distance of the buffer film, .theta. represents an angle between a plane parallel to the semiconductor **substrate** and a side surface of the element partitioning trench, and d represents a thickness of the oxidized film.